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John P. Kong

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: **Akio YONEYAMA**

Group Art Unit: **2613**

Serial No.: **09/515,896**

Examiner: **Tung T. Vo**

Filed: **February 29, 2000**

Confirmation No.: **9736**

For: **A VIDEO CODING APPARATUS ACCORDING TO A FEATURE OF A VIDEO PICTURE**

Attorney Docket No.: 000233
Customer Number: 38834

APPEAL BRIEF

April 11, 2005

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief follows from the Notice of Appeal filed February 9, 2005, with a shortened period for filing this Appeal Brief ending on April 11, 2005 (April 9 was a Saturday).

Please charge the fee for submission of this Appeal Brief to our Deposit Account No. 50-2866.

I. REAL PARTY IN INTEREST

The Real Party in Interest is KDD Corporation, with a mailing address of 3-2, Nishishinjuku 2-Chome, Shinjuku-ku, Tokyo, Japan.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

Claims 3, 7, 9, 11, 13, and 15-26 remain pending in the present application. Claims 1, 2, 4 – 6, 8, 10, 12 - 14 and 27 – 29 were cancelled. Claims 17 – 26 were withdrawn from consideration. The Applicants appeal the final rejection of claims 3, 7, 9, 11, 13, 15 and 16 set forth in the Office Action mailed on August 9, 2004.

IV. STATUS OF AMENDMENTS

No claim amendments were made in the response after final filed December 9, 2004. The claims stand as presented in the Amendment under 37 C.F.R. §1.111 filed on June 10, 2004.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to a video coding apparatus employing motion compensatory prediction coding of digital video signals, combining three kinds of video coding systems for P, B, and I frames (*see, e.g.*, the Background of the Invention section of the specification). As described generally on the bottom of page 3 to page 4 of the specification, a GOP is a "Group of Pictures" that refers to a minimum unit of video pictures, which are formed by combining the three kinds of coding systems and can be decoded independently of each other. The combination of coding systems is referred to as a "GOP structure." A frame first coded

inside one GOP is an intra-frame coding (an I frame). The number of frames included in one GOP is referred to as a GOP size. An interval between P frames or between an I frame and a P frame is referred to as a predictive frame interval.

Conventionally, an I frame inserting interval has been constant irrespective of the feature of the input video picture. In other words, the GOP size has been fixed conventionally, so that intra-frame coding has been forcibly carried out per predetermined number of frames, with negative impacts to achieving better coding efficiency (*see, e.g.*, page 4 of the specification). In addition, conventional video picture compression coding systems used a fixed predictive frame interval, or a predetermined use of either frame structure or field structure coding that also results in coding inefficiencies in certain circumstances (*see, e.g.*, bottom of page 4 to top of page 6 of the specification).

One primary feature of the present invention involves a ***variable*** GOP size (*see, e.g.*, page 7, lines 6-15). Another primary feature of the present invention is directed to determining an optimum predictive frame interval in a video picture (*see, e.g.*, page 7, lines 16-22). Independent claim 3 covers these features of the invention by reciting an intra-frame coding mode decision means for deciding a GOP boundary position when the inter-frame variance exceeds a predetermined value, wherein the inter-frame variance is calculated between timewise adjacent frames with respect to the input video signals. Claim 3 also recites the P frame interval inside one GOP being decided based on the decision by the P frame interval decision means for deciding a P frame interval for carrying out motion compensatory prediction coding based on the motion features between timewise adjacent frames with respect to the input video pictures. The

annotated claim 3 presented below is provided to show, by way of example only and without limitation thereto, some corresponding description in the present specification for one embodiment of the invention.

Claim 3: A video coding apparatus for coding a video picture by the use of motion compensatory prediction of each of video pictures with respect to sequentially input video signals, the video coding apparatus comprising:

inter-frame variance calculation means for calculating a variance between timewise adjacent frames with respect to the input video signals {*see, e.g.*, **inter-frame variance analysis section 32, Figs. 4, 7 and 9; page 11, line 23 to page 12, line 6; and page 14, line 20 to page 15, line 25**};

intra-frame coding mode decision means for deciding a GOP boundary position when the inter-frame variance exceeds a predetermined value {*see, e.g.*, **GOP boundary position decision section 33, Figs. 4, 7 and 9; page 12, lines 7-15; and page 15, line 26 to page 16, line 16**}; and

one-way coding (P) frame interval decision means for deciding a P frame interval for carrying out motion compensatory prediction coding based on the features between timewise adjacent frames with respect to the input video pictures, wherein the P frame interval inside one GOP being decided based on the decision by the P frame interval decision means {*see, e.g.*, **predictive frame interval decision section 35, Figs. 4, 7 and 8; page 12, line 24 to page 13, line 1; and page 19, line 18 to page 20, line 26**}.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 3, 7, 9, 11, and 13 were rejected under 35 U.S.C. §103 over **Kato et al.** (USP 6,151,360) in view of **Fujiwara**. Claims 14 – 16 were rejected under 35 U.S.C. §103 over **Kato**, **Fujiwara**, and further in view of **Igarashi et al.** (USP 6,324,216).

VII. ARGUMENT

With regard to one aspect of the prior art rejections, the examiner alleged that **Fujiwara** discloses a variable GOP boundary that is decided based on the inter-frame variance between time-wise adjacent frames. A previous Office Action relied upon Figs. 25A to 25C of **Fujiwara** for this feature. That reliance was overcome by the remarks set forth in the Amendment filed June 10, 2004. The Final Office Action relied newly upon the following disclosures of **Fujiwara** for this feature:

> "the image rearrangement control circuit (2) determines the positions of I, P, and B pictures that are read out from frame memory (1) in an order designated by reference frame interval determining circuit (13)"
>
> "the reference frame interval can be controlled with the interval being smaller than the number of frames of GOP, which means that the GOP boundary position is determined; see Fig. 14, note the order of input 0-7 frames is rearranged in order of coding I, B, P,B,P,P,P,P with the determined interval m=2 and m=1" and
>
> "motion vector detecting circuit detects the inter-frame variance between time adjacent frames, current frame, and previous frame; the reference frame interval determining circuit (13 of Fig. 7) determines whether the prediction efficiency exceeds a prescribed threshold, see col. 14, lines 1-17."

However, such disclosures of **Fujiwara** do not teach or suggest a GOP boundary position being decided based on the decision by the intra-frame coding mode decision means. As claimed, the GOP boundary positions (e.g., GOP size) ***vary*** based on when the inter-frame variance between timewise adjacent frames exceeds a predetermined value (and then the P frame intervals are decided based on the motion features between timewise adjacent frames ***within*** the GOP).

In particular, the discussion in the Final Office Action seems to assume that the reference frame interval m determined by the reference frame interval determining circuit 13 identifies the positions between two I pictures. This is incorrect. **Fujiwara** describes the reference frame interval m as an interval between an I picture and a next P picture, or an interval between a P picture and a next P picture, etc. as shown in Figs. 25A, 25C and 16. The reference frame interval m in **Fujiwara** is not described to include an interval between an I picture and a next I picture. Even when **Fujiwara** describes determining the appropriate reference frame interval, where the reference frame is an I picture, **Fujiwara** does not specifically determine the location of the ***next*** I picture. In particular, column 14, lines 26 – 27 state that the next I picture is "**predetermined**" to be the fifth frame (in the example for calculating the reference frame interval where the starting reference frame was an I picture). **Fujiwara** teaches no more than a predetermined or fixed GOP boundary. Therefore, **Fujiwara** does not specifically teach or suggest the ***variable*** GOP boundary position recited in claim 3, "deciding a GOP boundary position when the inter-frame variance (between timewise adjacent frames) exceeds a predetermined value" and "deciding a P frame interval ... based on the motion features between

timewise adjacent frames." For at least these reasons, the present claimed invention patentably distinguishes over the prior art.

In view of the above Arguments, it is respectfully requested that the final rejection of pending claims 3, 7, 9, 11, 13, 15 and 16 be reversed and the application placed into condition for allowance (claims 17-26 being withdrawn from consideration).

VIII. CLAIMS APPENDIX

An Appendix containing a copy of the claims involved in this appeal are attached following page 12 of this paper.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.

Application No.: 09/515,896
Appeal Brief dated April 11, 2005

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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Appendix I – Listing of Claims
Application No.: 09/515,896
Appeal Brief dated April 11, 2005

Listing of Claims:

Claims 1 - 2 (Canceled)

Claim 3 (Previously Presented): A video coding apparatus for coding a video picture by the use of motion compensatory prediction of each of video pictures with respect to sequentially input video signals, the video coding apparatus comprising:

inter-frame variance calculation means for calculating a variance between timewise adjacent frames with respect to the input video signals;

intra-frame coding mode decision means for deciding a GOP boundary position when the inter-frame variance exceeds a predetermined value; and

one-way coding (P) frame interval decision means for deciding a P frame interval for carrying out motion compensatory prediction coding based on the features between timewise adjacent frames with respect to the input video pictures,

wherein the P frame interval inside one GOP being decided based on the decision by the P frame interval decision means.

Claims 4-6 (Canceled)

Claim 7 (Original): A video coding apparatus according to claim 3, wherein the inter-frame variance is calculated by using at least one of an absolute difference between the

input video pictures and a pixel dispersion value of each of small blocks, into which the input video picture is divided.

Claim 8 (Canceled)

Claim 9 (Original): A video coding apparatus according to claim 3, wherein the P frame interval decision means divides the input video picture into small blocks and carries out simple motion compensatory prediction by the use of a representative value per small block so as to decide the P frame interval.

Claim 10 (Canceled)

Claim 11 (Original): A video coding apparatus according to claim 9, wherein the representative value uses either one of an average inside the small block and a dispersion value inside the small block.

Claim 12 (Canceled)

Claim 13 (Original): A video coding apparatus according to claim 3, wherein the P frame interval decision means controls to make the frame interval small in the case where a motion

compensatory prediction error is large while controls to make the frame interval great in the case where the motion compensatory prediction error is small.

Claim 14 (Canceled)

Claim 15 (Original): A video coding apparatus according to claim 3, further comprising means for dividing a target video picture into small blocks so as to judge an edge region inside the video picture based on the dispersion value of pixel information on the small block.

Claim 16 (Original): A video coding apparatus according to claim 3, further comprising coding complexity prediction means for predicting coding complexity in each coding system

based on the feature of the video picture inside the GOP so as to control a coding quantity at the time of coding in consideration of the complexity.

Claim 17 (Withdrawn): A video coding apparatus capable of coding a video picture by either a field structure or a frame structure, the video coding apparatus comprising:

means for discriminating whether each of sequentially input video pictures is an interlaced video picture or a non-interlaced video picture,

the means selecting coding by the field structure if the video picture is an interlaced video picture while the means selecting coding by the frame structure unless the video picture is an interlaced video picture.

Appendix I – Listing of Claims
Application No.: 09/515,896
Appeal Brief dated April 11, 2005

Claim 18 (Withdrawn): A video coding apparatus according to claim 17, wherein in order to discriminate whether the input video picture is an interlaced video picture or a non-interlaced video picture, the spacewise correlation of pixels continuous in a vertical direction at an arbitrary position inside the video picture is measured, so that the video picture is discriminated to be an interlaced video picture if the correlation between the same fields is higher than the correlation between different fields.

Claim 19 (Withdrawn): A video coding apparatus according to claim 18, wherein the coding by the field structure is selected in the case where the number of pixels satisfying the conditions expressed by inequalities (1) and (2) below exceeds a predetermined rate of the number of pixels satisfying the inequality (1) in measuring the spacewise correlation of the pixels continuous in the vertical direction:

$$Max(d(0,-2),d(0,2),d(-1,1)) < \text{threshold value} \quad \ldots (1)$$

$$(Max(d(0,-2),d(0,2),d(-1,1))+offset) < Min(d(0,-1),d(0,1)) \quad \ldots (2)$$

wherein, a and b represent pixel position in the vertical direction, d(a,b) represents an absolute difference between a and b.

Claim 20 (Withdrawn): A video coding apparatus capable of coding a video picture by either a field structure or a frame structure, the video coding apparatus comprising:

means for calculating the correlation between two video pictures with a timewise interval with respect to sequentially input video pictures; and

means for deciding whether the coding is carried out by either a field structure or a frame structure based on the correlation,

the coding by the frame structure being carried out in the case of the higher correlation than a predetermined value while the coding by the field structure being carried out in the case of the lower correlation than it.

Claim 21 (Withdrawn): A video coding apparatus according to claim 20,

wherein the means for calculating the correlation between the two video pictures comprises:

means for creating a downscaled plane in consideration of features of sequentially input video pictures; and

means for performing simple motion estimation processing on the downscaled plane, and

wherein the coding by the field structure is selected in the case where a motion compensatory prediction error obtained by the simple motion estimation processing is larger than a predetermined value.

Claim 22 (Withdrawn): A video coding apparatus according to claim 21, wherein the means for creating the downscaled plane in consideration of the feature of the video picture

divides the video picture into small blocks and calculates a deviation per divided small block, the deviation being an element of the downscaled plane.

Claim 23 (Withdrawn): A video coding apparatus according to claim 20, further comprising means for discriminating whether the input video picture is an interlaced video picture or a non-interlaced video picture,

wherein a video picture variance is analyzed, so that the coding by the field/frame structure is selected by detecting the correlation between the two video pictures with respect to only the video pictures which are discriminated to be interlaced video pictures, while the coding by the frame structure is selected with respect to the video pictures which are not discriminated to be interlaced video pictures.

Claim 24 (Withdrawn): A video coding apparatus according to claim 21, further comprising means for discriminating whether the input video picture is an interlaced video picture or a non-interlaced video picture,

wherein a video picture variance is analyzed, so that the coding by the field/frame structure is selected by detecting the correlation between the two video pictures with respect to only the video pictures which are discriminated to be interlaced video pictures, while the coding by the frame structure is selected with respect to the video pictures which are not discriminated to be interlaced video pictures.

Appendix I – Listing of Claims
Application No.: 09/515,896
Appeal Brief dated April 11, 2005

Claim 25 (Withdrawn): A video coding apparatus according to claim 23, further comprising means for switching and setting the interlaced/non-interlaced video pictures,

wherein it is discriminated whether one video picture input first or a plurality of video pictures are interlaced video pictures or non-interlaced video pictures, so that the means for switching and setting the interlaced/non-interlaced video pictures is set based on the discrimination result.

Claim 26 (Withdrawn): A video coding apparatus according to claim 24, further comprising means for switching and setting the interlaced/non-interlaced video pictures,

wherein it is discriminated whether one video picture input first or a plurality of video pictures are interlaced video pictures or non-interlaced video pictures, so that the means for switching and setting the interlaced/non-interlaced video pictures is set based on the discrimination result.

Claims 27 – 29 (Canceled)